26. (Twice Amended) A method of marketing telephone lines to customers, comprising:

speed pre-qualifying each line for high-speed digital service or low-speed digital service by using one-ended electrical measurements;

receiving requests for high speed digital data service from customers; and

connecting at least a portion of the lines qualified for high-speed digital service to customers requesting high-speed digital service in response to receiving said requests.

31. (Twice Amended) A system for characterizing performance of customer lines for data transmission, comprising:

a computer;

a telephony switch coupled to a portion of the lines and adapted to connect the portion to a network, to perform one-ended electrical measurements on the portion, and to transmit the measurements to the computer;

a measurement unit coupled to the switch and computer, the unit to make the measurements on a selected line at a lower frequency in response to receiving a command from the computer, the computer to predict data rates at a higher frequency for the selected line from the measurements, the computer being further adapted to:

predict whether the selected line is disqualified for data transmission from the measurements thereon.

53. (Twice Amended) A method of detecting a bridged tap in a customer line, comprising:

making one-ended electrical measurements on the customer line;

determining [ome] one or more admittances as a function of frequency of the customer line from the measurements; and

detecting that the customer line has a bridged tap in response to finding a signature of a bridged tap in the one or more admittances as a function of frequency.

54. (Amended) The method of claim 53, wherein [the signature is a frequency dependent property of one or more admittances] the method is used in qualifying a line for high speed data services and the one ended measurements are made at a frequency below the frequency of the high speed data services signals..

CLAIMS

Nov. 1, 2001

1. A method of predicting performance of a customer line for data transmission, comprises:

measuring electrical properties of the customer line from a central location;

identifying a line model for the customer line from the measurements;

identifying a modem model for a modem selected for use with the line, the modem model providing performance data on the selected modem; and

predicting performance data for the customer line when operated with the selected modem by combining the line and modem models.

2. The method of claim 1, wherein the performance data comprises a data transmission rate.

3. The method of claim 2, further comprising:

predicting whether the customer line is disqualified for data transmission; and

wherein the act of predicting performance data is in response to predicting that the line is not disqualified.

4. The method of claim 1, wherein the act of measuring includes using the measurements to evaluate at least one admittance of the customer line at a plurality of frequencies.

5. The method of claim 4, wherein the act of measuring includes finding at least two of Y_{tr}, Y_{rg}, and Y_{tg} for the customer line.

6. The method of claim 5, wherein the act of identifying a line model comprises:

determining a frequency dependent attenuation from the admittances; and

determining a normalized line length from the frequency dependent attenuation.

7. The method of claim 4, wherein the act of identifying a line model comprises:

determining whether the customer line has a bridged tap.

8. The method of claim 1, wherein the act of identifying a line model includes finding a frequency dependent line attenuation from the measurements.

9. The method of claim 1,

wherein the act of measuring includes driving the customer line with a signal at a plurality of frequencies; and

the act of identifying a line model includes evaluating a property of the customer line for frequencies high with respect to the frequencies of the signal.

10. The method of claim 1, wherein the act of measuring includes finding a noise level, a capacitance, and frequency dependent admittances for the customer line.

11. The method of claim 2, wherein the modem model indexes predicted data rates by an averaged normalized line length and a noise level of the customer line.

12. (Amended) A method of speed qualifying a customer line for data transmission, comprises:

identifying a proxy line in a cable carrying the customer line;

performing one-ended electrical measurements on the proxy line; and

predicting a data rate for the customer line from the measurements.

13. The method of claim 12, wherein the act of predicting a data rate further comprises:

identifying a line model for the proxy line from the measurements;

identifying a modem model for a modem to use with the customer line; and

combining the modem model with the line model to obtain the data rate.

14. The method of claim 13, wherein the act of identifying a line model includes finding at least two of Y_{tr}, Y_{rg}, and Y_{tg} for the proxy line at a plurality of frequencies.

15. The method of claim 14, further comprising one of inferring a mix of wire gauges and inferring the presence of a bridged tap from the found admittances.

16. The method of claim 14, wherein the act of identifying a line model includes finding a frequency dependent line attenuation from the measurements.

17. The method of claim 12,

wherein the act of performing includes driving the proxy line with a signal having a plurality of frequencies; and

the act of identifying a line model includes evaluating a property of the proxy line for frequencies high with respect to the frequencies of the signal.

18. (Amended) The method of claim 13, wherein the modem model indexes predicted data rates by an averaged normalized line length and a noise level of the customer line.

19. A method of marketing telephone lines to customers, comprising:

speed pre-qualifying a plurality of the customer lines using one-ended electrical measurements performed from a central location; and

setting billing rates of at least a portion of the lines at prices that depend on the speed qualification of the portion.

20. The method of claim 19, wherein at least a portion of the acts of speed qualification include performing electrical measurements on a proxy line.

21. The method of claim 19, further comprising:

monitoring a portion of the customer lines after being placed in service by

repeatedly performing one-ended electrical measurements on the portion; and

determining new data rates of each line of the portion from the repeated measurements.

22. The method of claim 19, wherein each act of speed pre-qualifying, comprises:

measuring electrical properties of one of the lines from the central location;

identifying a line model for the one of the lines from the measured electrical properties;

identifying a modem model for a modem to use with the one of the lines, the modem model to provide rate data on the selected modem; and

predicting a data rate for the one of the lines when operated with the selected modem by combining the line and modem models.

23. The method of claim 22, the act of speed pre-qualifying the one of the lines further comprising:

predicting whether the one of the lines is disqualified for data transmission; and

wherein the act of predicting a data rate is in response to predicting that the one of the lines is not disqualified.

24. (Amended) A method of marketing telephone lines to customers, comprising:

speed qualifying each customer line from one-ended electrical measurements, the speed qualifying classifying the lines for high speed digital service or low speed digital service; and

offering the high-speed service to at least a portion of the customers in response to the portion having lines qualified to support high-speed digital service.

25. The method of claim 24, wherein each act of speed qualifying comprises:

measuring electrical properties of one of the lines from the central location;

identifying a line model for the one of the lines from the electrical properties;

identifying a modem model for use with the one of the lines, the modem model providing data rates for the selected modem; and

predicting a data rate for the one of the lines when operated with the selected modem by combining the line and modem models.

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26. (Twice Amended) A method of marketing telephone lines to customers, comprising:

speed pre-qualifying each line for high-speed digital service or low-speed digital service by using one-ended electrical measurements;

receiving requests for high speed digital data service from customers; and

connecting at least a portion of the lines qualified for high-speed digital service to customers requesting high-speed digital service in response to receiving said requests.

27. The method of claim 26, wherein each act of speed pre-qualifying comprises:

measuring electrical properties of one of the lines from the central location;

identifying a line model for the one of the lines from the electrical properties;

identifying a modem model for use with the one of the lines, the modem model providing transmission rate data on the selected modem; and

predicting a data rate for the one of the lines when operated with the selected modem by combining the line and modem models.

28. The method of claim 27, wherein at least a portion of the measurements are performed on a proxy line.

30. (Amended) The system of claim 31, wherein the computer is adapted to:

identify a line model for the selected line from the measurements thereon;

identify a modem model for use with the selected line; and

predict a data rate for the selected line when operated with the selected modem by combining the line and modem models.

31. (Twice Amended) A system for characterizing performance of customer lines for data transmission, comprising:

a computer;

a telephony switch coupled to a portion of the lines and adapted to connect the portion to a network, to perform one-ended electrical measurements on the portion, and to transmit the measurements to the computer;

a measurement unit coupled to the switch and computer, the unit to make the measurements on a selected line at a lower frequency in response to receiving a command

from the computer, the computer to predict data rates at a higher frequency for the selected line from the measurements, the computer being further adapted to:

predict whether the selected line is disqualified for data transmission from the measurements thereon.

32. The system of claim 30, wherein the computer is adapted to:

determine a frequency dependent attenuation from the measurements; and

determine a normalized line length from the frequency dependent attenuation.

33. The system of claim 30, wherein the computer is adapted to command the measurement unit to order measurements on proxy lines and to predict data rates for a portion of the customer lines by using the measurements on the proxy lines

34. A program storage device encoding an executable program for a method of speed qualifying telephone lines for data transmission, the method comprising:

measuring electrical properties of a customer line from a central location;

identifying a line model for the customer line from the measurements;

identifying a modem model for use with the line, the modem model providing data rates of the selected modem; and

predicting a data rate for the customer line when operated with the selected modem by combining the line and modem models.

35. The device of claim 34, the method further comprising:

predicting whether the customer line is disqualified for data transmission; and

wherein the act of predicting a data rate is performed in response to predicting that the line is not disqualified.

36. The device of claim 34, wherein the act of measuring includes finding at least one admittance of the customer line at a plurality of frequencies by using the measurements.

37. The device of claim 36, wherein the act of measuring includes finding at least two of Y_{tr}, Y_{rg}, and Y_{tg} for the customer line.

38. The device of claim 36, wherein the act of identifying a line model includes finding a frequency dependent line attenuation from the measurements.

39. The device of claim 36, wherein the act of identifying a line model comprises:

determining a frequency dependent attenuation from the admittances; and

determining a normalized line length from the frequency dependent attenuation.

40. The device of claim 34, wherein the modem model lists predicted data rates by averaged normalized line length and noise level of the customer line.

41. The device of claim 40, the method further comprising:

modifying the predicted data rate in response to a value of one or more quality parameters, the values characterizing the selected modem.

42. The device of claim 41, wherein the parameters are selected from the group consisting of impulse noise compensation, noise floor, echo compensation and phase instability compensation.

43. The device of claim 34, the method further comprising:

identifying the customer line as a proxy line for a second telephone line; and

predicting a data rate for the second line from the data rate predicted for the proxy line.

44. A method of determining the attenuation of a customer's telephony line, comprising:

performing a plurality of one-ended measurements of frequency dependent admittances of the customer's telephony line, the measurements being performed in a first frequency range;

processing the measurements by a set of logical decision trees; and

adjusting values of a frequency-dependent attenuation for an average telephony line to predict an attenuation of the customer's telephony line in a second frequency range, the act of adjusting being responsive to results from the logical decision trees.

45. The method of claim 44, wherein the act of performing includes finding at least two of Y_{tr}, Y_{rg}, and Y_{tg} for the customer's telephony line.

46. A method of determining performance of a customer telephone line, the line having both a tip wire and a ring wire, comprising:

driving one of the two wires with a first alternating voltage at one end and the other of the two wires with a second voltage at the same end and measuring voltages between each wire and ground while driving the two wires;

driving the other of the two wires with a third alternating voltage at the same end and the one of the two wires with a fourth voltage at the same end and measuring voltages between each wire and ground while driving the two wires;

driving both the tip and the ring wires with a fifth alternating voltage from the same end and measuring voltages at the tip and ring wires while driving both wires; and

determining admittance Y_{tg} at a plurality of frequencies from the measured voltages.

47. The method of claim 46, further comprising:

determining an apparent length of the customer line from values of said admittance at a plurality of frequencies.

48. The method of claim 46, further comprising:

determining whether the customer line has a bridged tap from values of said admittance at a plurality of frequencies.

49. The method of claim 46, further comprising:

determining the remaining admittances Y_{rg} and the admittance Y_{rt} at a plurality of frequencies from the measured voltages.

50. The method of claim 49, further comprising:

determining a frequency-dependent attenuation of the line from the measured admittances.

51. The method of claim 50, further comprising:

predicting a data rate for the line from the attenuation; and

adjusting the predicted data rate in response to a rating of a gauge mix of the line.

52. The method of claim 50, further comprising:

determining whether the customer line has a bridged tap from values of said admittances at a plurality of frequencies;

predicting a data rate for the line from the attenuation; and

adjusting the predicted data rate in response to determining that the customer line has a bridged tap.

53. (Twice Amended) A method of detecting a bridged tap in a customer line, comprising:

making one-ended electrical measurements on the customer line;

determining one or more admittances as a function of frequency of the customer line from the measurements; and

detecting that the customer line has a bridged tap in response to finding a signature of a bridged tap in the one or more admittances as a function of frequency.

54. (Amended) The method of claim 53, wherein the method is used in qualifying a line for high speed data services and the one ended measurements are made at a frequency below the frequency of the high speed data services signals.

55. The method of claim 53, wherein the one or more admittances is an admittance between a wire of the customer line and ground.

56. The method of claim 53, wherein the act of making one-ended measurements performs the measurements through a voice test access of a telephony switch.

57. (Amended) The method of claim 53, further comprising:

determining whether a ratio of imaginary and real parts of a frequency derivative of one of the one or more admittances has a peak; and

wherein the determining is based on finding an above threshold peak in the ratio.